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SILVERLEAF WHITEFLY AND OKRA-LEAF COTTON – THE LEAF AREA FACTOR

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Abstract

A three-year study from 1999 to 2001 was conducted in Arizona to correlate trichome density, leaf perimeter and leaf area to the silverleaf whitefly, *Bemisia tabaci* (Gennadius) biotype B densities observed in the field. Five normal-leaf varieties and 4-5 okra-leaf varieties were compared each year. Tichome density was highly correlated to the whitefly densities while leaf perimeter per leaf also played a significant role.

Introduction

We have studied cotton plant traits for potential host plant resistance development for whitefly control since 1992 (Chu et al. 1997). Okra-leaf cottons in general support significantly lower numbers of adults, eggs, and nymphs compared to normal-leaf cottons (Chu et. al. 2001). This report presents some of the morphological traits related to the susceptibility to whitefly colonization.

Materials and Methods

The studies were conducted at the University of Arizona Maricopa Agricultural Research Center at Maricopa, AZ from 1999 to 2001. The soil is Casa Grande sandy loam (Post et al. 1988). Standard agronomic practices were followed each year. Randomized complete block designs with four replicates were used in the studies. Treatments were normal- and okra-leaf varieties selected, respectively, from the United States and Australia. The normal-leaf varieties were Deltapine (DPL) 20B, 50B, 90B, NuCOTN 33B, and Stoneville (ST) 474; and okra-leaf varieties were Fiber Max (FM) 819 and 832, Siokra L-23 and Siokra I-4, 89013114, E 0223, E 0798, and E 1028. The varieties used in the study each year is shown in Table 1. Plots were eight rows wide and 12.2 m long with rows 1 m apart. There were two unplanted rows between plots and 3 m wide alleys between blocks. Seeds were planted and watered for germination on 19, 13, and 16 April for 1999, 2000, and 2001, respectively. Plants emerged about two weeks later and were watered at 10-20 d intervals during the growing seasons. Plots were not treated with any insecticides except for diflubenzuron (1-(4-chlorophenyl-3-(2,6- difluorobenzoyl urea))) for the control of salt marsh caterpillars, *Estigmene acrea* (Drury) (Lepidoptera: Archtiidae) on 13 August in 1999.

Densities of *B. tabaci* biotype B on cotton at Maricopa, AZ, were estimated at 7-d intervals from 21 July to 6 October in 1999, from 10 July to 5 September in 2000, and 2 July to 20 August. On each sampling date, three plants per plot were randomly selected in 1999 and 2000, and five in 2001. Leaves were picked from the 1st, 3rd, 5th, 7th, 10th, and 15th main stem nodes in 1999, from the 1st to 5th and 7th nodes in 2000, and from 1st to 5th nodes in 2001. The nodes were in ascending numbers beginning with the first expanded leaf below the plant main terminal. Leaves from the 1st node measured ≥ 2.5-cm between the two largest leaf lobes. Among the nodes, the 15th was the lowest position on the main stems at the time of sampling. A 2-cm^2 leaf disk was taken from the area adjacent to center primary vein at the basal area of the leaves (Naranjo and Flint 1994). Numbers of eggs and nymphs were counted on underleaf disk surfaces with the aid of a stereoscope. Adults per leaf were counted from underleaf surfaces of same number of leaf positions on the main stem nodes described but from different plants using leaf-turn method (Naranjo and Flint 1995). Leaf area and perimeter of each sampled leaf during the growing season were measured with a leaf area meter (CI-400 CIAS Image Analysis, CID, Inc., Vancouver, WA).

Data were analyzed using ANOVA for orthogonal comparisons. Correlations between *B. tabaci* biotype B whitefly densities and leaf area, leaf perimenter, and leaf perimeter/leaf area were calculated.

Results and Discussion

There were no significant differences between normal- and okra-leaf varieties in the adult silverleaf whitefly population densities adults per leaf, or eggs and nymphs per cm^2 leaf disk in the 1999 study, however, the differences were significant in the 2000 and 2001 studies. Area per leaf was consistently greater for normal-leaf varieties compared with okra-leaf varieties for the 1999 to 2001 studies. Trichome density was positively correlated to adult, egg and nymph densities for the 1999 to 2001 studies and leaf perimeter per leaf was negatively correlated to the silverleaf whitefly densities except the egg density in 1999. The correlations between area per leaf and silverleaf whitefly densities varied from one year to the other. The correlations between the ratioes of leaf perimeter toand leaf area and whitefly densities were significantly different in the 2000 and 2001 studies, but not the 1999 sttudies. It appears that trichome density on the underleaf surface is the primary factor that attracts whiteflies but leaf perimeter also has a significant influence on the whitefly densities. The micro-environment such air movement, humidity, and ambient temperatures on the underleaf surface could be a mechanism that partially explain the whitefly densities observed for different cotton varieties under field conditions.

References

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Table 1. Normal- and okra-leaf cotton varieties studied for susceptibility to *Bemisia tabaci* biotype B colonization at Maricopa, AZ, 1999-2001.

Variety[a]	**Leaf type N or O**[b]	**1999**	**2000**	**2001**
DPL 20B	N	X	X	X
DPL 50B	N	X	X	X
DPL 90B	N	X	X	X
NC 33B	N	X	X	X
ST 474	N	X	X	X
89013114	O	X	-	-
FM 819	O	X	-	-
FM 832	O	X	-	-
S I-4	O	X		
S L-23	O	X	X	X
E 0223	O	-[c]	X	X
E 0798	O	-	X	X
E 1028	O	-	X	X
Total	N	5	5	5
	O	5	4	4

[a]Cotton seeds were provided: Siokra cultivars by Cotton Seed Distributors Ltd., Dalby, Queensland, Australia; numbered (orka-leaf) strains including the three E strains by Australia's Commonwealth Scientific and Industrial Research Organization; Narrabri, Australia; the two FiberMax cultivars by Aventis CropScience, Research Triangle Park, NC; All DPL, and NuCOTN 33B by Delta and Pine Land Co., Scott, MS.
[b]N and O denote normal- and okra-leaf varieties, respectively.
[c]X denotes the variety tested in the study.